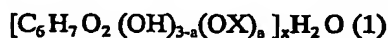


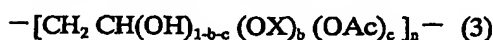
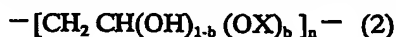
CLAIMS

What is claimed is:

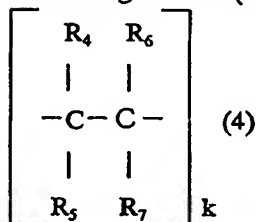
1. A cationic graft-copolymer of a water-soluble linear backbone polymer having hydroxyl groups, for a non-viral gene delivery vector, comprising a unit derived from a cationic water-soluble linear polysaccharide of the following formula (1)



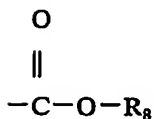
or a unit derived from a water-soluble linear polyvinylalcohol of the following formula (2) or a partial hydrolyzed alcohol of the following formula (3)



Wherein X is a $-(CH_2)_mR_1$ organic radical where R_1 is a member of the class consisting of $-NH_2$ radical, $-N(CH_3)_2$ radical, $-N(C_2H_5)_2$ radical, $-N^+(C_2H_5)_3$ radical, $-N^+(CH_2)_2CH_2CH(OH)CH_3$ radical, $-N^+(C_2H_5)_2CH_2CH(OH)CH_3$ radical, $-N^+(C_2H_5)_2(C_2H_5)N(C_2H_5)_2$ radical, $-C_6H_4NH_2$ radical, and $-COC_6H_4NH_2$ radical, $-COR_2$ radical where R_2 is $-CH_2NH_2$ or $-C_6H_4NH_2$, $-CH_2CH(OH)CH_2R_3$ radical where R_3 is $-NH_2$, $-N(CH_3)_2$, $-N(C_2H_5)_2$, and $-N^+(C_2H_5)_3$ radical, m is a natural number of 1 to 3, a is a positive number having a value of $0 < a < 3$, b is a positive number having a value of $0 < b < 1$, x and n are natural numbers having a value of 5 or more, $1 > b + c$, and Ac is acetyl radical; and a unit derived from a polymerize-able olefin compound of the following formula (4)

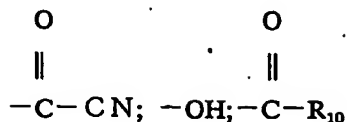


Wherein R_4 , R_5 and R_6 are each selected from the group consisting of hydrogen and CH_3 and R_7 is a member of the group consisting of

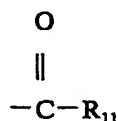


Where R_8 is a member of the class consisting of hydrogen, $C_1 - C_{12}$ alkyl radicals, cyclohexyl radical, $C_1 - C_4$ hydroxyalkyl radicals, $C_1 - C_8$ aminoalkyl radicals, $C_1 - C_8$ dialkylaminoalkyl radicals, glycidyl radical, tetrahydrofuran radical, $C_1 - C_4$ lower alkyl-substituted tetrahydrofuran radical, benzyl radical, the $(CH_2CH_2O)_yCH_2CH_2OH$ radical where y is a positive integer from 1 to 10, and $-N(R_9)_2$ where the two R_9 s which may be the same or different, are

either hydrogen or a C₁–C₄ alkyl radical;

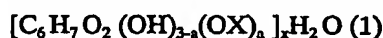


Where R₁₀ is a C₁–C₈ alkyl radical; phenyl radical; tolyl radical; pyridine radical; pyrrolidone radical; and

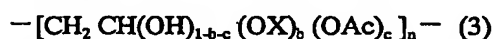
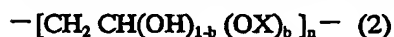


Where R₁₁ is NH₂, NHCH₃, N,N-dimethylamino radical, N,N-dimethylaminopropylamino radical, and morpholine radical.

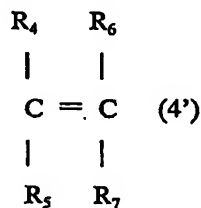
2. A process for preparing a cationic graft-copolymer of a water-soluble linear backbone polymer having hydroxyl groups, for a non-viral gene delivery vector, which comprises reacting a cationic water-soluble linear polysaccharide of the following formula (1)



or a unit derived from a water-soluble linear polyvinylalcohol of the following formula (2) or a partial hydrolyzed alcohol of the following formula (3)

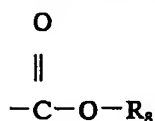


Wherein X is a $-(\text{CH}_2)_m\text{R}_1$ organic radical where R₁ is a member of the class consisting of $-\text{NH}_2$ radical, $-\text{N}(\text{CH}_3)_2$ radical, $-\text{N}(\text{C}_2\text{H}_5)_2$ radical, $-\text{N}^+(\text{C}_2\text{H}_5)_3$ radical, $-\text{N}^+(\text{CH}_2)_2\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$ radical, $-\text{N}^+(\text{C}_2\text{H}_5)_2\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$ radical, $-\text{N}^+(\text{C}_2\text{H}_5)_2(\text{C}_2\text{H}_5)\text{N}(\text{C}_2\text{H}_5)_2$ radical, $-\text{C}_6\text{H}_4\text{NH}_2$ radical, and $-\text{COC}_6\text{H}_4\text{NH}_2$ radical, $-\text{COR}_2$ radical where R₂ is $-\text{CH}_2\text{NH}_2$ or $-\text{C}_6\text{H}_4\text{NH}_2$, $-\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{R}_3$ radical where R₃ is $-\text{NH}_2$, $-\text{N}(\text{CH}_3)_2$, $-\text{N}(\text{C}_2\text{H}_5)_2$, and $-\text{N}^+(\text{C}_2\text{H}_5)_3$ radical, m is a natural number of 1 to 3, a is a positive number having a value of $0 < a < 3$, b is a positive number having a value of $0 < b < 1$, x and n are natural numbers having a value of 5 or more, $1 > b + c$, and Ac is acetyl radical; with a polymerize-able olefin compound of the formula (4')

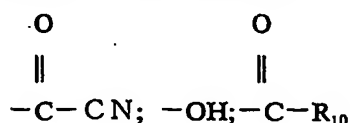


Wherein R₄, R₅ and R₆ are each selected from the group consisting of hydrogen and CH₃

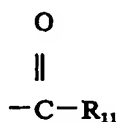
and R_7 is a member of the group consisting of



Where R_8 is a member of the class consisting of hydrogen, $C_1 - C_{12}$ alkyl radicals, cyclohexyl radical, $C_1 - C_4$ hydroxyalkyl radicals, $C_1 - C_8$ aminoalkyl radicals, $C_1 - C_8$ dialkylaminoalkyl radicals, glycidyl radical, tetrahydrofuran radical, $C_1 - C_4$ lower alkyl -substituted tetrahydrofuran radical, benzyl radical, the $(\text{CH}_2\text{CH}_2\text{O})_y\text{CH}_2\text{CH}_2\text{OH}$ radical where y is a positive integer from 1 to 10, and $-\text{N}(\text{R}_9)_2$ where the two R_9 s which may be the same or different, are either hydrogen or a $C_1 - C_4$ alkyl radical;

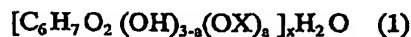


Where R_{10} is a $C_1 - C_8$ alkyl radical; phenyl radical; tolyl radical; pyridine radical; pyrrolidone radical; and

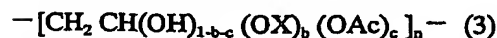
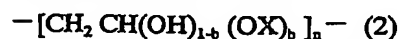


Where R_{11} is NH_2 , NHCH_3 , N,N -dimethylamino radical, N,N -dimethylaminopropylamino radical, and morpholine radical.

3. A complex between a cationic graft-copolymer of a water-soluble linear backbone polymer having hydroxyl groups and DNA, comprising a unit derived from a cationic water-soluble linear polysaccharide of the following formula (1)



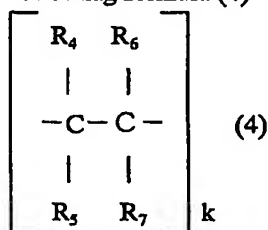
or a unit derived from a water-soluble linear polyvinylalcohol of the following formula (2) or a partial hydrolyzed alcohol of the following formula (3)



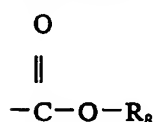
Wherein X is a $-(\text{CH}_2)_m\text{R}_1$ organic radical where R_1 is a member of the class consisting of

$-\text{NH}_3^+$ radical, $-\text{NH}^+(\text{CH}_3)_2$ radical, $-\text{NH}^+(\text{C}_2\text{H}_5)_2$ radical, $-\text{N}^+(\text{C}_2\text{H}_5)_3$ radical, $-\text{N}^+(\text{CH}_2)_2\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$ radical, $-\text{N}^+(\text{C}_2\text{H}_5)_2\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$ radical, $-\text{N}^+(\text{C}_2\text{H}_5)_2(\text{C}_2\text{H}_5)\text{N}(\text{C}_2\text{H}_5)_2$ radical, $-\text{C}_6\text{H}_4\text{NH}_3^+$ radical, and $-\text{COC}_6\text{H}_4\text{NH}_3^+$ radical, $-\text{COR}_2$ radical where R_2 is $-\text{CH}_2\text{NH}_3^+$ or $-\text{C}_6\text{H}_4\text{NH}_3^+$, $-\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{R}_3$ radical

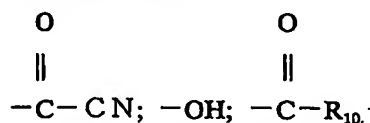
where R_3 is $-\text{NH}_3^+$, $-\text{NH}^+(\text{CH}_3)_2$, $-\text{NH}^+(\text{C}_2\text{H}_5)_2$, and $-\text{N}^+(\text{C}_2\text{H}_5)_3$ radical, m is a natural number of 1 to 3, a is a positive number having a value of $0 < a < 3$, b is a positive number having a value of $0 < b < 1$, x and n are natural numbers having a value of 5 or more, $1 > b + c$, and Ac is acetyl radical; a unit derived from a polymerize-able olefin compound of the following formula (4)



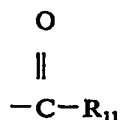
Wherein R_4 , R_5 and R_6 are each selected from the group consisting of hydrogen and CH_3 and R_7 is a member of the group consisting of



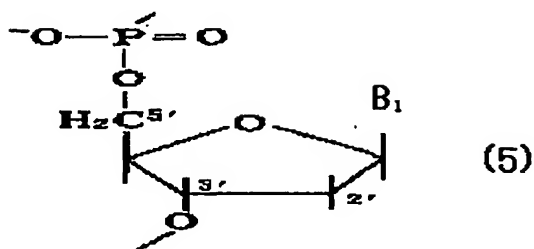
Where R_8 is a member of the class consisting of hydrogen, $\text{C}_1 - \text{C}_{12}$ alkyl radicals, cyclohexyl radical, $\text{C}_1 - \text{C}_4$ hydroxyalkyl radicals, $\text{C}_1 - \text{C}_8$ aminoalkyl radicals, $\text{C}_1 - \text{C}_8$ dialkylaminoalkyl radicals, glycidyl radical, tetrahydrofuran radical, $\text{C}_1 - \text{C}_4$ lower alkyl-substituted tetrahydrofuran radical, benzyl radical, the $(\text{CH}_2\text{CH}_2\text{O})_y$, $\text{CH}_2\text{CH}_2\text{OH}$ radical where y is a positive integer from 1 to 10, and $-\text{N}(\text{R}_9)_2$ where the two R_9 s which may be the same or different, are either hydrogen or a $\text{C}_1 - \text{C}_4$ alkyl radical;



Where R_{10} is a $\text{C}_1 - \text{C}_8$ alkyl radical; phenyl radical; tolyl radical; pyridine radical; pyrrolidone radical; and

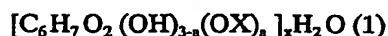


Where R_{11} is NH_2 , NHCH_3 , N,N -dimethylamino radical, N,N -dimethylaminopropylamino radical, and morpholine radical; and a unit derived from a poly(deoxyribonucleotide) of the following formula (5) as a recurring unit.

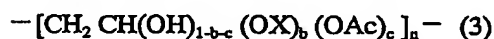
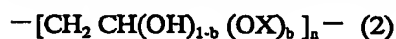


Where B_1 is a base selected from the group of adenine, thymine, guanine, and cytosine.

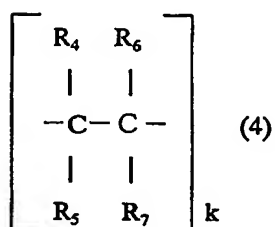
4. A complex between a cationic graft-copolymer of a water-soluble linear backbone polymer having hydroxyl groups and RNA, comprising a unit derived from a cationic water-soluble linear polysaccharide of the following formula (1)



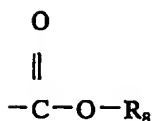
or a unit derived from a water-soluble linear polyvinylalcohol of the following formula (2) or a partial hydrolyzed alcohol of the following formula (3)



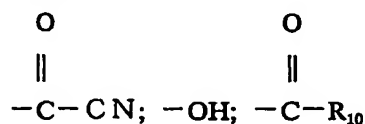
Wherein X is a $-(CH_2)_mR_1$ organic radical where R_1 is a member of the class consisting of $-NH_3^+$ radical, $-NH^+(CH_3)_2$ radical, $-NH^+(C_2H_5)_2$ radical, $-N^+(C_2H_5)_3$ radical, $-N^+(CH_2)_2CH_2CH(OH)CH_3$ radical, $-N^+(C_2H_5)_2CH_2CH(OH)CH_3$ radical, $-N^+(C_2H_5)_2(C_2H_5)N(C_2H_5)_2$ radical, $-C_6H_4NH_3^+$ radical, and $-COC_6H_4NH_3^+$ radical, $-COR_2$ radical where R_2 is $-CH_2NH_3^+$ or $-C_6H_4NH_3^+$, $-CH_2CH(OH)CH_2R_3$ radical where R_3 is $-NH_3^+$, $-NH^+(CH_3)_2$, $-NH^+(C_2H_5)_2$, and $-N^+(C_2H_5)_3$ radical, m is a natural number of 1 to 3, a is a positive number having a value of $0 < a < 3$, b is a positive number having a value of $0 < b < 1$, x and n are natural numbers having a value of 5 or more, $1 > b + c$, and Ac is acetyl radical; a unit derived from a polymerize-able olefin compound of the following formula (4)



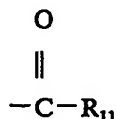
Wherein R_4 , R_5 and R_6 are each selected from the group consisting of hydrogen and CH_3 and R_7 is a member of the group consisting of



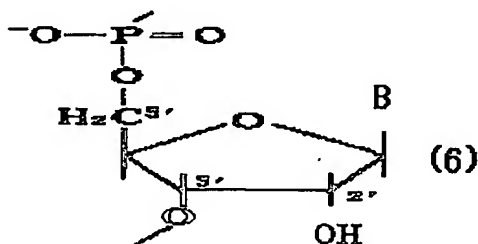
Where R_8 is a member of the class consisting of hydrogen, $\text{C}_1 - \text{C}_{12}$ alkyl radicals, cyclohexyl radical, $\text{C}_1 - \text{C}_4$ hydroxyalkyl radicals, $\text{C}_1 - \text{C}_8$ aminoalkyl radicals, $\text{C}_1 - \text{C}_8$ dialkylaminoalkyl radicals, glycidyl radical, tetrahydrofuran radical, $\text{C}_1 - \text{C}_4$ lower alkyl -substituted tetrahydrofuran radical, benzyl radical, the $(\text{CH}_2\text{CH}_2\text{O})_y\text{CH}_2\text{CH}_2\text{OH}$ radical where y is a positive integer from 1 to 10, and $-\text{N}(\text{R}_9)_2$ where the two R_9 's which may be the same or different, are either hydrogen or a $\text{C}_1 - \text{C}_4$ alkyl radical;



Where R_{10} is a $\text{C}_1 - \text{C}_8$ alkyl radical; phenyl radical; tolyl radical; pyridine radical; pyrrolidone radical; and



Where R_{11} is NH_2 , NHCH_3 , N,N -dimethylamino radical, N,N -dimethylaminopropylamino radical, and morpholine radical; and a unit derived from a poly(ribonucleotide) of the following formula(6) as a recurring unit.



Where B is a base selected from the group of adenine, uracil, guanine, and cytosine.

5. A gene delivery system using a complex between the cationic graft-copolymer and DNA, of Claim 3.
6. A gene delivery system using a complex between the cationic graft-copolymer and RNA, of Claim 4.